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Multi-model Super-Ensembles (SE) aim at combining optimally different models. A dynamic Kalman Filter version of this technique has been applied on a unique set of in-situ data and operational ocean models during the Dynamic of the Adriatic in Real-Time (DART) field experiment and is shown to significantly improve forecast skills.

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MULTI-MODEL SUPER-ENSEMBLE OCEAN PREDICTION: AN OPERATIONAL EXAMPLE USING A KALMAN FILTER IN THE ADRIATIC SEA

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Abstract
Multi-model Super-Ensembles (SE) aim at combining optimally different models. A dynamic Kalman Filter version of this technique has been applied on a unique set of in-situ data and operational ocean models during the Dynamics of the Adriatic in Real-Time (DART) field experiment and is shown to significantly improve forecast skills.
Keywords : Adriatic Sea, Models, Monitoring, Acoustics, Mesoscale Phenomena.

An increasing number of models are routinely providing operational weather forecasts and climate predictions. The SE technique [1], which uses an optimised combination of an ensemble of models, has previously been demonstrated to improve forecast skills in atmospheric models. Applications in the ocean are promising [2, 3]. However, they suffer from the lack of *in-situ* time series available in real-time.

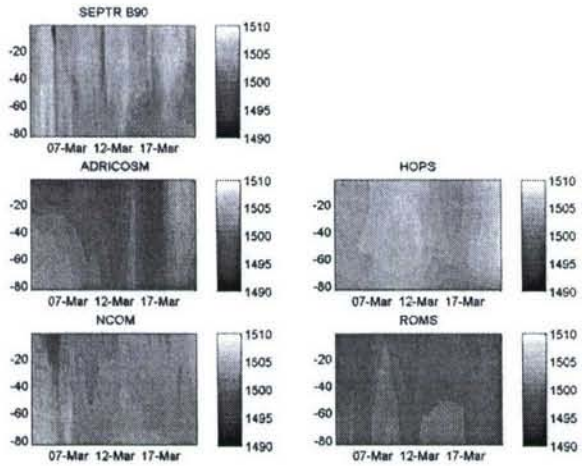

Fig. 1. Time series of sound velocity (m/s) profiles, from top to bottom and left to right: SEPTR data, ADRICOSM, HOPS, NCOM and ROMS models.

The trawl-safe bottom mounted SEPTR platform developed at NURC (NATO Undersea Research Center), which is equipped with an ADCP and a CTD profiling unit transmitting data in real-time through a dedicated Globalstar link, now overcomes this limitation. During the DART (Dynamics of the Adriatic in Real-Time) field experiment in March 2006, 6 SEPTR were moored in the Gulf of Manfredonia in the Adriatic. In parallel, a suite of atmospheric, wave and ocean models were run operationally for the same period. This unique combination of data and models (Fig. 1) was used to derive SE products using a Kalman Filter-like Dynamic Linear Model [4] to account for the rapid changes in individual model skills and derive associated uncertainties. Our results suggest that the combination of SEPTR and operational models may decrease the errors on sound velocity profiles from 3-5 m/s down to 1-2 m/s (Fig. 2) at a marginal cost.

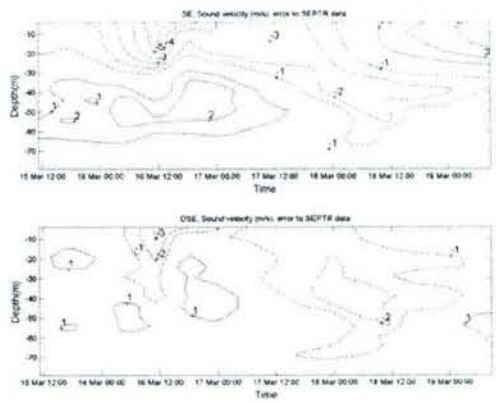

Fig. 2. Error on sound velocity for a 4-day forecast: (top) Standard Superensemble (bottom) Kalman Filter Dynamic Linear Model.

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References

1 - Krishnamurti T., Kishtawal C., LaRow T.E., Bachiochi D.R., Zhang Z., Williford C.E., Gadgil S. and Surendran S.S., 1999. Improved weather and seasonal climate forecasts from multimodel superensemble. *Science*, 285 (5433): 1548-1550. DOI: 10.1126/science.285.5433.1548.
2 - Rixen M. and Ferreira-Coelho E., 2004. Operational prediction of acoustic properties in the ocean using multi-model statistics. *Oc. Mod.*, 11 (3-4): 428-440. DOI:10.1016/j.ocemod.2005.02.002.
3 - Rixen M. and Ferreira-Coelho E., 2006. Operational surface drift prediction using linear and non-linear hyper-ensemble statistics on atmospheric and ocean models. *J. Marine Syst.*, in press.
4 - Shin D. and Krishnamurti T., 2003. Short- to medium-range superensemble precipitation forecasts using satellite products: 1. Deterministic forecasting. *J. Geophys. Res.*, 108 (8): 8383, DOI 10.1029/2001JD001510.